

Calcareous algae (dasycladales and charophytes), essential for the sedimentological interpretation of ancient coastal-lakes systems. The Barremian-Aptian Leza Fm., Cameros Basin, N Spain

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The sedimentology of ancient coastal-lakes systems is always hard to decipher, due to the coexistence of continental and marine environments. The Cretaceous Leza Fm. carbonates offer an outstanding opportunity to unravel this complexity using the study of calcareous algae.

The Leza Fm. (Barremian-Aptian in age) outcrops in the northern margin of the Cameros Basin, a rift basin filled with continental sediments from Tithonian to Albian times. The Leza Fm. carbonates were deposited in different environments of a coastal-lakes system with influence of freshwater and marine-water, as evidenced by the microfossil content (ostracods, charophytes, dasycladales and foraminifers). Dasycladales and charophytes are common components and occur together in some sequences of this unit, implying that they were deposited in the same environment but, did they live in the same environment?

Salpingoporella urladanasi is the only species of dasycladales found in the Leza Fm. Despite this low diversity, it is very abundant, occurring in numerous sequences. This green alga was commonly associated with ostracods, charophytes and foraminifers in lagoons of the northern Tethys during Barremian-Albian times.

Two charophyte assemblages are observed in the thin-sections of the Leza Fm. Assemblage A shows predominance of porocharacean gyrogonites associated with portions of *Charaxis* thalli. Assemblage B shows predominance of clavatoracean utricles (mainly *Atopochara*) associated with portions of *Clavatoraxis* thalli. Dasycladales commonly co-occur with assemblage A, but are very rare in assemblage B. Both assemblages do not generally occur together in the same sequence. Since the presence of homogeneous assemblages of porocharaceans in the Early Cretaceous is considered as indicative of brackish environments, we interpret that assemblage A sequences were formed in coastal-lakes with strong marine influence and salinities ranging from brackish to normal-marine; whereas assemblage B sequences were formed in coastal-lakes with strong meteoric water influence and low to very low salinity.

The alternation of these two sequences suggests that both fresh- and brackish-water coastal-lakes coexisted laterally during the same time. However, locally, a cm-scale interbedding of dasyclad-rich microfacies and charophyte-rich microfacies is observed, suggesting that short-lasting periodical changes in water salinity also occurred within the same lake, controlling the algal population: during periods of marine water influence dasyclads thrived in the lake and charophytes would have remained vegetative; whereas periods of freshwater input would have favored the development of charophytes. Similar changes happen in present-day coastal wetlands such as the Camargue (France) or the Everglades (USA). Therefore, the answer to the initial question is that both calcareous algae were deposited in the same sedimentary system, but the variable salinity of the system controlled their habitat, favoring the development of one of them, either in coeval lakes or in the same lake through time.

In conclusion, the study of calcareous algae of the Leza Fm. sets an extraordinary analogue of processes observed in present-day coastal wetlands and might be very useful to understand other ancient examples.

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